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THINGS TO COME

How Science May Shape the Next Twenty-five Years

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A Radio Discussion by

- RALPH GERARD
- WILLIAM OGBURN
- GERALD WENDT

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JANUARY 3, 1943

THE UNIVERSITY OF CHICAGO

ROUND TABLE

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NOTE

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THINGS TO COME

How Science May Shape the Next Twenty-five Years

A UNIVERSITY OF CHICAGO ROUND TABLE

BROADCAST COAST TO COAST BY
THE NATIONAL BROADCASTING COMPANY
SUNDAY, JANUARY 3, 1943, AT 1:30 P.M., C.W.T.

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WILLIAM F. OGBURN, Department of Sociology, University of Chicago

GERALD L. WENDT, Science Editor, *Time Magazine;* formerly of Department of Chemistry, University of Chicago

(*See pages 23–24 for further information*)

The ROUND TABLE, oldest educational program continuously on the air, is broadcast entirely without a script, although participants meet in advance, prepare a topical outline, and exchange data and views. Subjects are chosen because of their social, political, or economic significance. The program has no "ax to grind." In the selection of speakers, the effort is to provide a balanced discussion by participants who have special competence and knowledge. The opinion of each speaker is his own and in no way involves the responsibility of either the University of Chicago or the National Broadcasting Company.

THINGS TO COME

How Science May Shape the Next Twenty-five Years

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What is the promise and the meaning of science to present-day Americans? Have you wondered what the world will be like after the war ends?

What are the outstanding inventions that will mold future society? How has the war speeded up mechanical research? What will be the place of the airplane, the automobile, in post-war society? What social effects will these changes have?

What are the advances being made in the field of medicine and disease today? What significance will these have for the next generation? What sort of changes will come in foods?

All these vast changes in the field of science mean that society is affected in some way. What role should education, for example, assume in preparing the world for change? What significance will such changes have for the family of nations?

To discuss these and other problems involved in "Things To Come," the University of Chicago ROUND TABLE *presented three expert observers.*

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MR. OGBURN: This is the first broadcast of the new year, and we can promise you "blood, sweat, and tears." But, beyond that, there are visions of better horizons. Science looks to the future, does it not?

MR. WENDT: Yes. I'm very much impressed with a tour that I recently made of the research laboratories of this country. Both in

the universities and in the industries very startling new things are developing which will certainly emerge on a surprised world the moment this war is over.

MR. GERARD: But let me strike a note of caution there. I also made an extended trip through Europe, shortly before this war started, and saw hundreds of laboratories busily engaged in creative work. Since then the headlines in the papers day after day announce the destruction of those buildings. What will happen in the next twenty-five years is largely a matter of what kind of countries are doing it.

MR. OGBURN: This is certainly an unusual topic for the ROUND TABLE—inventions and technology. I suggest that we pursue a slightly unusual procedure, namely, that you, Mr. Gerard, and I keep quiet for a little while and let us ask Mr. Wendt, who has had wide experience as a science editor, as a professor in chemistry, and as an observer of business and technology in the United States, to take a few minutes and tell us briefly what he sees as to the future of technology and invention.

MR. GERARD: I'll do my best.

MR. WENDT: Good; that's a wonderful chance.

It is perfectly possible to look ahead to what is being done and what will strike us within the next five years—I wouldn't say twenty-five.

But the tragic thing—almost a desperate thing—is that people do not realize that by looking into the laboratories one can see ahead and predict.

One can see social problems sticking their heads up over the horizon. Even before the war, you know, we spent about four hundred million dollars a year on industrial research, new products, new industries, and the development of inventions, which do not come overnight. Anyone who knows what is going on in the laboratories cannot fail to see great social consequences. There's no reason to be surprised, because the laboratory is the birthplace of the future.

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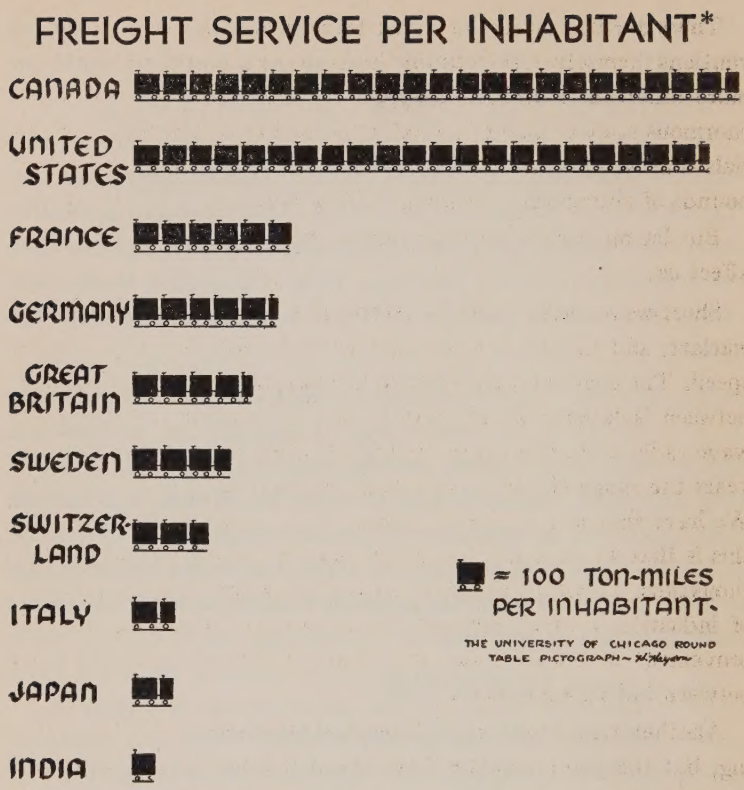

* Bureau of Railway Economics.

Now, because of the war, but in spite of much military secrecy, to be sure, there are many developments that I think we should pay attention to. I think myself that the speeding-up of research due to the war will give us more changes in the first five years after the war than we've had in the past whole generation.[1]

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[1] More than a century was consumed in bringing the crude-rubber production of the world up to a million tons yearly. The United States alone is now undertaking to do almost as big a job in less than two years by the manufacture of chemical rubbers from petroleum, alcohol, and coal and limestone. It is planned that, at the end of 1943, production of aluminum will be at a rate almost seven times greater than was attained in 1939, after fifty years of development.

There are two factors involved there, really: one is the new inventions themselves, such as the short-wave radio, and perhaps even more important is the fact that great new industries have reached an enormous scale of quantity production and face us with new materials that we never had before, such as synthetic rubber, billions of pounds of aluminum, and things of that sort.

But let me take a few examples of these things that I think will affect us:

Short-wave radio—that is responsible for modern mechanized warfare, and the needs of the war have developed it with a great speed. The communication between tanks, planes, and submarines, between isolated units of infantry, all are possible now by short-wave radio and have made the tactics of warfare. In the past few years the range of useful wave-lengths has been greatly increased. We have shorter and shorter waves at our disposal. The result of this is that we have not just a few channels in the air but literally thousands. It will be possible to use short-wave radio for all kinds of industrial control, agricultural operations, lumbering, the improvement of police work, and even for private communication between individual persons.[2]

Another item is television. Everybody has heard that that's coming, but the plane detector has proved it a useful and important instrument in the war, for it enables us to detect planes away over

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[2] ". . . . spectacular and significant has been the development of radiotelephony. It is commonplace for the commander of an air squadron either in the air, on a carrier, or at a land base, to converse with the pilot of each plane. This was made possible by advances in the use of extremely short waves. Each time the wave length is cut in half the number of individual radio channels is doubled. Today the air is not crowded since many thousands of individual channels are available.

"One form of radiotelephony—'the walkie-talkie,' or portable receiver and transmitter—will have direct postwar applications. It can be used to control large construction projects with scattered units, lumbering and mining operations, truck fleets, and even large-scale agricultural management. It is not fantastic to say that as many channels may become available as there are persons in most cities" (*Fortune* supplement, December, 1942).

the horizon, and by night, and behind the clouds. What we don't realize is that that is essentially a television device. The quantity production of instruments of that sort means that television is really around the corner.[3]

Another subject would be plastics. There again we have great new industries. Synthetic rubber can be considered a plastic.[4] Nylon, of course, is, and there are our new textiles. There are also transparent materials that are used for the windows of bombers, for the turrets, very strong materials that are used for making plywood, whole boats made out of single sheets of veneer, cemented by the new plastics.

I've already mentioned aluminum. See what a challenge there is to thousands of manufacturing organizations in the availability of about a million tons of aluminum every year.[5]

In addition to that, the development of the plane is obvious. The

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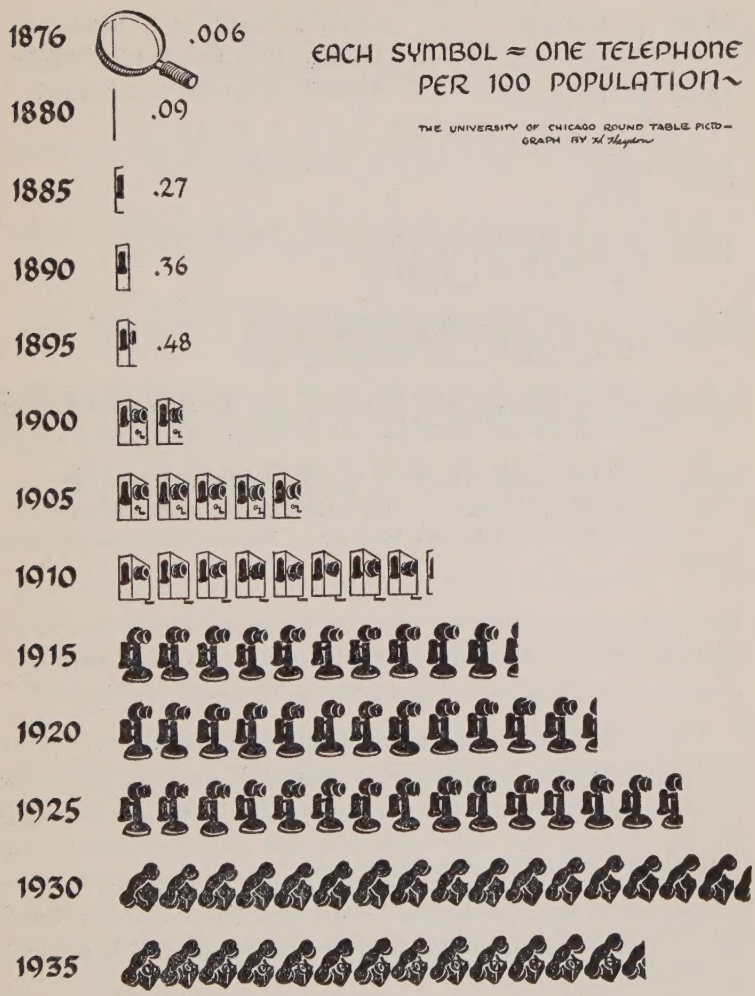
[3] ". . . . The first postwar application of this device is already being prominently advertised—its installation on shipboard to prevent collisions with the shore, other ships, or icebergs. . . . . It has given such an impetus to the manufacture of shortwave transmitters, receiving tubes, and luminous screens that an improved television will be one of the earliest postwar industries" (*ibid.*).

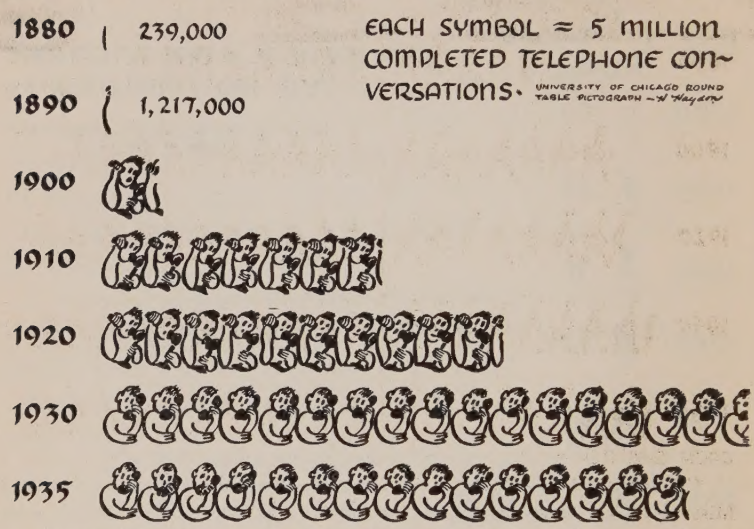
[4] ". . . . If the Baruch Committee's recommendations are carried through, the U.S. will emerge from the war with a synthetic rubber production equal to twice our prewar imports of natural rubber. We shall have a capacity of 1,106,000 tons, most of it in Buna-S. This huge industry will be in a good position to compete with natural rubber. No exact cost figures on Buna-S are available, but the estimates range from 15 cents to 30 cents a pound. The price of natural rubber in 1939 was 17.9 cents a pound; but synthetic rubber's enthusiasts believe it will give at least 50 per cent more mileage in tires than natural rubber. In any case, there will (or can) be rivalry, which is the best assurance of still further product and process development for both synthetic and natural rubber" (*ibid.*).

[5] ". . . . The U.S. will produce at the annual rate of 2,100,000,000 pounds of aluminum by the end of next year; this is 60 per cent more than the whole world produced in 1938. It is enough aluminum to rebuild every railroad passenger car in the U.S. every four months. Its price, now 15 cents a pound, may go as low as 10 cents or even less. At such a price it could capture many a market now reserved to steel, especially in transportation, where weight means operating cost" (*ibid.*).

TELEPHONE DEVELOPMENT IN THE UNITED STATES*



* National Resources Planning Board.



* Reports previous to 1890 are incomplete. National Resources Planning Board.

fast fighter planes, our great transport planes, which are now developing into cargo planes—the possibility of private aircraft later on—it staggers the imagination, and it's a real thing right at hand.

Mr. Gerard: Before you go on firing more material at us that we can't really digest in this time, I wonder if we can take a few minutes to go over one or two of those points a little more thoroughly. Mr. Ogburn, not only have you had great experience as a sociologist but you were also responsible for the particularly voluminous report on *Technological Trends and National Policy* that's going to be a standard in that field for years to come.[6] I hope you'll

[6] *Technological Trends and National Policy* (Washington: United States Government Printing Office, 1937). This report of the subcommittee on technology of the National Resources Committee discusses the social implications of new inventions.

* The Cotton Belt includes North Carolina, South Carolina, Georgia, Alabama, Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas. Adapted from Census of Agriculture, 1935, by National Resources Planning Board.

give us some of your views as to the social consequences of these things.

What about this matter of improved communication by short-wave radio and by television?

Mr. Ogburn: It's going to make the whole United States one big main street. Television will break down states' rights more than did the Civil War. The airplane manufacturer is doing more to concentrate affairs down in Washington than Alexander Hamilton ever dreamed. Nationalism will be greatly increased, also, I think, by the chemical inventions, which, for example, make rubber from oil and alcohol, and thus make us less dependent upon foreign trade. The chemical industries naturally favor the high tariffs and the independence of states from foreign products, so that these inventions encourage large, powerful states like the United States, like Russia, and like a consolidated Europe.

Mr. Gerard: On the other hand, don't you think that it will eventually go beyond that and surpass the state boundaries? But perhaps we're getting too far away on that at the moment.

Mr. Wendt, what do you see in the future of plastics and metals? You've told us about them as individuals. How will they come together and affect our implements and activities?

Mr. Wendt: I think that the best way to take that is in a specific example of the application. I suppose what comes closest to all of us is the car. I'm asked all the time about the car, and I've discussed this with men who know. It seems perfectly obvious that the availability of such large quantities of aluminum will mean a car that is light—a car with its top and its fenders and part of its body made of aluminum. The availability of plastics again means that the windows will be large and that we'll have plenty of vision toward the rear and toward the side. I visualize a very roomy car. For that matter, I might insert here the fact that our great production of 100-octane gasoline probably means a very small engine over the rear axle.[7]

Mr. Ogburn: This new car is going to break down a good deal of our isolationism, together with the airplane, the television, the radio, and facsimile transmission. The farmer in the village will be very different. The airplane will also aid in the distribution of mail, while a facsimile transmission will print bulletins and a newspaper in the

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[7] ". . . . The engine is likely to be rated at about forty horsepower, not ninety as at present. The present large engine involves a waste of much steel and fuel. The future engine will use very high octane fuel and a supercharger when extra power is needed. This requires a dual carburetor and a dual gas tank so arranged that the secondary fuel supply and supercharger can be automatically cut in. . . . . The use of strong aluminum alloys, together with a reduction in the weight of the engine and the use of light plastics, could well reduce the weight of the car to one-half that of pre-war standard. This in turn would probably result in giving forty miles per gallon, even of the ordinary motor fuel, and a lower first cost. Thus the number of automobiles in use is likely to increase rather than to decrease from prewar figures" (*Fortune* supplement, December, 1942).

home of the farmer and the village housekeeper. The farmer will become more and more like the city businessman, and television will bring him pictures of happenings and also place the motion picture in his home, with its portrayal of different customs and mores.

MR. GERARD: Of course, the airplane is bound to do much more elaborate things than that. I imagine, Mr. Wendt, that you had in mind two types of airplane changes. One would be the local traffic, so to speak, from one town to another, and that perhaps you would think of in terms of the helicopter, wouldn't you?

MR. WENDT: I think that the development of transport planes will be very wide. We'll have a return to communication between towns over great distances, over continents.

MR. GERARD: That's the other thing; that's international transport.

MR. WENDT: Plenty of it. As far as the individual is concerned, of course, I believe that the plane is likely to be a plane of the helicopter type, or something like that. That's the plane with a windmill instead of a wing—that is able to rise and set vertically, perfectly safe. In fact, it is foolproof.

MR. OGBURN: That is, it is sort of a taxi for the city, is it not—sort of a taxi and bus service?

MR. WENDT: Possibly.

MR. OGBURN: That will increase the subdivision development.

MR. GERARD: So that a helicopter may pick people up on a regular route and deposit them at their regular place of work.

MR. OGBURN: There's another variation of the airplane that we hear about a lot these days—the bomber. One of the interesting things is that the bomber, in a ruthless world, makes impossible the life of a small nation. These small nations really have to hang on the tail of some big neighbor that has coal and iron and can produce

bombers and tanks and so forth, unless, of course, we have a world federation and a league of nations.

Mr. Gerard: Yes. The air force is to be used as one means of policing that international world that we're coming to.

May I, as a doctor, throw in another thought about this transportation over great distances? As soon as we have rapid movement from one great continent to another, so that fleas and lice and bacteria, which ordinarily would have died out in the course of moving across the ocean, arrive soon enough to be alive, we'll have the transplantation of huge groups of diseases and tremendous epidemics. It's very important that such agencies as the Rockefeller Foundation are already spending millions of dollars in fighting plagues that have come from Africa to South America.

Mr. Wendt: Again there is the fact that the world is one community. It will be tied much more closely by all these developments.

Mr. Gerard: It is getting smaller all the time.

Mr. Wendt: Mr. Gerard, you asked about the private plane. It seems to me that perhaps the most interesting picture here is the development of housing, prefabricated housing, the putting-together of houses—not like tin cans, as people seem to think, but in small standardized units, interchangeable parts, so that you can build a television set right into the house.

Mr. Gerard: Is that going to mean that all of us will live in exactly the same sort of place, or can we make use of the possibility of plastics to get better variation?

Mr. Ogburn: May I answer that by saying that it's going to enhance very greatly the family living and change the family institution. There will be more air-conditioning, I think, which will tend to make the civilization move southward. It's held its course northward up to this time. That may be an effect of air-conditioning. At the same time, these houses will be very much more comfortable as

places of abode, by reason of the many electrical conveniences, such as fluorescent lighting, heating, new tool shops, air purifiers, and so forth. The plastics will mean more highly colored furnishings and decorations also.

MR. GERARD: Does that mean that there's going to be more "keeping up with the Joneses" but that it will be easier to keep up?

MR. OGBURN: I think that it's really going to mean that the home will become a place of recreation. Steam, you know, took recreation out of the home and put it into the movie, but the electrical inventions are bringing it back into the home.

MR. WENDT: What I'd like to see is a house that really fits people who live in it and not somebody who used to live in it. With the electrical house one can do that.

MR. OGBURN: Some of these inventions we're mentioning, too, change personal habits a very great deal. Chemical clothing, I think, will be more common in the future—women's dresses made of glass and thin chemical suits for men's summer wear and much greater use of rubber and plastics, for instance, in the clothing that we wear.

MR. GERARD: May I interrupt you? These are tremendously exciting and important immediate consequences that we can all see just around that famous corner, but one will also be interested in some of the long-range problems and the possibilities that will result if really revolutionary inventions and discoveries are made possible in the field of technology. For example, what about tapping the really great sources of power?

MR. WENDT: If I could be sure of living to the year 2000, I certainly could get excited about that—and that's not very far away. There is power beyond any great conception. I regret that the work on cosmic rays and atom-smashing had to be stopped by this war. Those are two fields to watch. Cosmic rays will tell us about the interior structure of the atom and the cyclotron, and other means of

atom-measuring seem to promise sources of power which are far beyond and millions of times as great as anything that we have had.

MR. GERARD: The old story of the lump of coal taking the liner across the ocean.

MR. WENDT: That's an old story, and it sounds trite, but it's a perfectly real possibility.

MR. GERARD: That's really in the future.

MR. OGBURN: Power has meant in the past practically the giving to each individual the equivalent of one hundred slaves, and under these new power inventions which we visualize for the long-time future one man might have two hundred or five hundred slaves. It's certainly going to change the personal habits of a great many of us.

MR. WENDT: There's no limit to the possibilities.

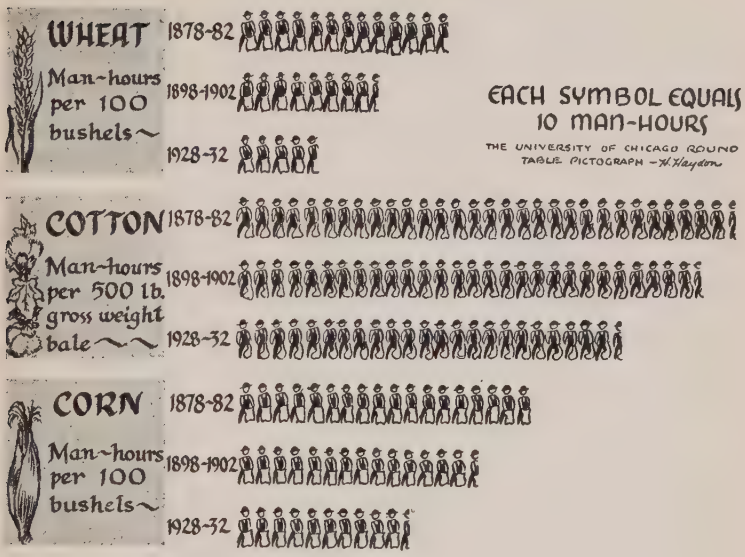
MR. OGBURN: I think that we ought to turn to another long-range type of research, namely, biology, and follow our unusual procedure of you and me, Mr. Wendt, keeping quiet for a little while, while Mr. Gerard tells us about the happenings in biology.

Mr. Gerard, you know, is a physician as well as a research biologist and has visited research laboratories all over the world. He really can tell us very much about what's happening in this field.

MR. GERARD: Thank you, Mr. Ogburn. I'd like to pick up right where Mr. Wendt left off—on the tapping of future energy sources. While not so tremendous as subatomic energy, the capturing of sunlight more extensively and with better control by the use of chlorophyll—the green stuff of leaves—is very nearly upon us. When we can expose great trays of this to sunlight and reap a harvest of pure foods, we will use a much greater fraction of the sun's energy than we do now when we grow green plants spaced widely over millions of acres.

Another point on the food question is already foreshadowed by the use of dehydrating processes. Few people in this country realize

ESTIMATED MAN-HOURS NEEDED IN AGRICULTURE*



* National Resources Planning Board.

what an enormous industry this has already become. Dehydrating foods eliminates the water and makes possible the transport and preservation over long times and in compact form of the necessary fuel- or calory-supplying substances. Of course, new vitamins will be discovered, and the present ones will be used on a greater scale to supplement the fuel portion of our diets. But these matters are not so much in the scientific realm for the future; they are at the stage of invention and that of social application. I can leave the further discussion of that to you later, Mr. Ogburn.

But the really exciting part of biological things to come are the new discoveries yet to be made, and these, of course, I can only guess at. Take, for example, the question of cancer. We've already improved the methods of diagnosis and of early operation so that a very large fraction of cancer patients can be saved. But this is still

patchwork. The real solution will come from discovery of what goes wrong in cells, and particularly in their growth processes, so that one or a few run wild and multiply beyond reason.[8]

Such discoveries are becoming possible by the use of the new physical instruments and the experiments that they make possible. For example, we now have tracer atoms which can be built into molecules which are administered to animals and the path of the atom and the changes in the molecule followed through the body. One way of tagging is with a radioactive atom, the presence of which can be easily detected with sensitive electrical devices. Just as a gunner uses tracer bullets to check his aim, the biochemist is using tracer atoms. Already it has turned out that one supposedly basic difference between plants and animals is only partly valid, for animals as well as plants can build carbon dioxide and water into foods, although they cannot use the energy of sunlight to do it.

Another example is the electron microscope, an electrical magnifier, which will enlarge perhaps a thousand times as much as the best optical microscope. With it we are rapidly eliminating that great *terra incognita* between the smallest cell part which can be seen with the usual microscope, perhaps one twenty-thousandth of an inch, and the largest molecule which the physicist and chemist have measured, but not seen, at about one ten-millionth of an inch. Between these two dimensions lie the great protein molecules, such as viruses and others concerned with cell growth. Thus, we shall certainly complete the blueprints of cell structure and greatly increase our understanding of cell function.

The consequences will flow sooner or later; not only a solution of

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[8] "Probably the attempts to control cancer by the administration of large daily doses of dried raw egg-white attracted most medical attention. Growth, whether normal or abnormal, is dependent on biotin, one of the vitamins. Avidin, the active principle of egg-white, neutralizes biotin. Assuming that an excess of biotin causes cells to proliferate it should be theoretically possible to check a tumor and even to cause it to disappear by giving a cancer patient large doses of avidin or dried raw egg-white" (Waldemar Kaempffert, "The Year's Science News in Review," *New York Times*, December 27, 1942).

the cancer problem but the ability to prepare, deliberately, drugs and other substances which can modify cell growth—as the accidently discovered drug colchicine, which has already multiplied the size and food yield of plants—drugs which specifically hold in check or destroy disease bacteria, including perhaps the tuberculosis germ, as the sulfa drugs and gramacidin already do for many.[9]

Another entirely different direction of progress will be in the combating of old age diseases, such as high blood pressure. Important forms of this are related to kidney disease, and some of the substances which produce and which prevent high blood pressure are already in bottles in the laboratory.

But think of the possibilities that will result should it become possible to replace entirely an injured kidney by transplanting into the body a healthy one. So far, such organ transplantation has been achieved only in so simple a case as the transparent front of the eye, but there is no reason now for supposing that the successful transplantation of complex organs will not one day be possible.

Of course, all these changes will tremendously increase life expectancy so that more of us will remain healthy for a longer time. But I must at least give passing mention to the question of what we do with this gift of life, aside from the sociological consequences which we can come back to.

Modern psychology and psychiatry have developed tremendously in the past decades but so far have had very little impact on human affairs. We now know in some detail how the child is the psychological father of the man and the sort of home rearing and

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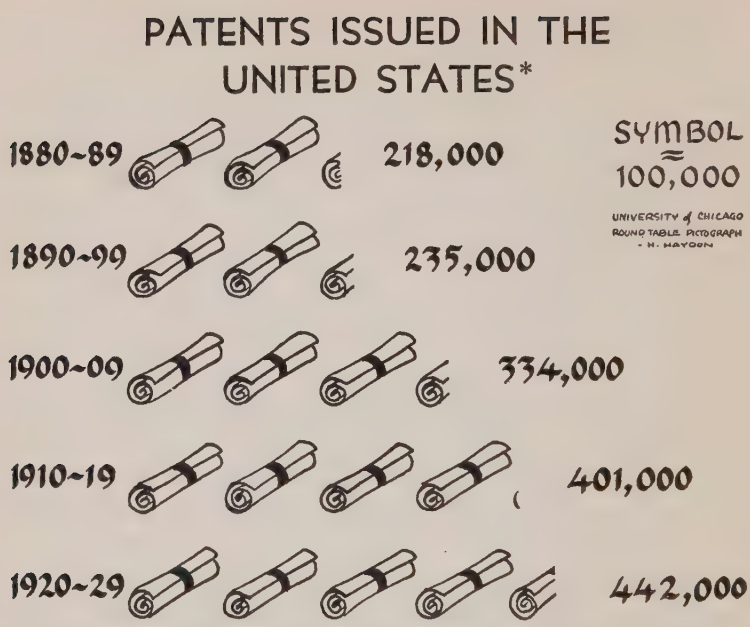
[9] "The sulfa drugs were applied in new ways last year with astounding results. A newcomer is sulfapyrazine, a chemical twin of sulfadiazene. Until sulfapyrazine appeared sulfadiazene was the only sulfa preparation that checked streptococci, staphylococci and pneumococci. . . . . Another new sulfa drug, sulfasuxidine or succinyl-sulfathiazole, was found to have a specific effect in infections of the gastro-intestinal tract and to cause less internal disturbance than sulfadiazene. . . . . Because the sulfa drugs are not always effective in the treatment of local wounds incurred in battle Majors G. A. Mitchell and G. A. H. Buttle of the British armed forces in North Africa used proflavin with sulfanilamide. The results were miraculous . . . ." (*ibid.*).



* In first third of twentieth century there were 1,330,000 patents issued in the United States. National Resources Planning Board.

formal education which will help to so direct the urges of love and hate, which all have, to decrease personal conflict and world wars and to increase mutual cooperation.

Mr. Ogburn: All these are interesting things that you're talking about—many are impressive—but I think that food to me is especially interesting. The idea of synthesis of foods probably will change our habits of restaurants toward the drug store, and we shall probably go to the soda fountain to get synthetic carbohydrates and proteins from this dehydrated food. That will affect, of course, agriculture quite a little bit, too, will it not?

Mr. Wendt: I don't quite agree with you there. I don't think we're going to go to the drug store to get carbohydrates. I think very likely that we'll know so much about vitamins that we can get

them there safely, but we'll never improve on the sunshine and the cow and the hog for making our proteins out of our fats. I think that we can go from dehydrated foods into having available large quantities of powder proteins, so to speak, as we already have powdered carbohydrates now.

MR. GERARD: Yes. We can never get below that bulk need of the diet. All the vitamins will do is supplement that in the usual way.

May I just toss in one last word on vitamins here? We hear so much of them now, and everybody refers to them as able to cure insanity and stunted growth and weakness, and so on; but, remember, they can cure only those things which are due to the lack of vitamins—not anything at all that comes along.

It often makes me think of that story of the man whose hand was injured. He went to the doctor for treatment and was very eager to find out if it would be completely cured. The doctor assured him that it would be.

"Well, Doctor, will I be able to play the piano?"

"You certainly will."

"Well, that's wonderful. I never could before."

MR. OGBURN: We can't count on miracles happening from the vitamins, but there is a possibility of improving the physical well-being of man very much by the better food he may eat under these new conditions.

MR. WENDT: I'm terribly interested in what you said about the extension of life-expectancy. I'm getting along to where I would like to see some progress in that direction.

MR. GERARD: The expectation for Wendt ought to be included in this. He'll live to a ripe old age, at least, under our present knowledge. If he gets pneumonia now, he's got a much better chance than he would have had a few years ago.

MR. OGBURN: Isn't the weight of all these old people that are to be in our society going to be a sort of dead weight of conservatism hanging on society and be a stoppage of progress?

MR. GERARD: I think that that's a very important aspect of it; and the change in the balance between old and young in the problem of productivity.

MR. WENDT: Mr. Ogburn, you have thought a lot about that. I'd like to have your answer on that.

MR. OGBURN: I'm inclined to think that it will add a conservative note to our politics and make our radicalism a little less easy. But it's also likely to bring a new type of radical, a man like Townsend. Townsend was only a forerunner of a really great pension for our old age, yet to come.

But I was also interested, Mr. Gerard, in what you said about education. You think that there's great hope for education in these new adventures in psychiatry?

MR. GERARD: I don't see how we can help but greatly improve the techniques and wisdom of education. For one thing, the technological improvement that will make educational devices better. What about that?

MR. OGBURN: That is, of course, a very interesting thing. I think that just around the corner are talking books. You don't hear very much about them, but that would revolutionize, possibly, our reference libraries and our classrooms.

MR. GERARD: Would we join the unemployed, then?

MR. OGBURN: There's technological unemployment ahead for us. But that's a very small matter in comparison with the utilization by our schools of television, radio, and talking books. Microfilm, particularly, is a new gadget which we scholars will have to use.

MR. GERARD: Yes, and so it will be possible to reach a much larger number of people with wise educational procedures and instruction. What the instruction will be in turn is being told us by the advances in psychology and psychiatry.

MR. OGBURN: We have gone over a number of new inventions and new scientific discoveries and have seen how each one of them

may affect our society—be good or bad for us. I wonder if it wouldn't, finally, for the third stage of our program, be a good idea to take a little look to see whether we can't pull this together and see if there is any over-all meaning for humanity out of it; see whether there is any challenge to us.

You're a philosopher as well as a physician and a biologist, Mr. Gerard. What do you see?

MR. GERARD: I'm a jack-of-all-trades.

I'd just like to make one point there, to see if you both agree with me. After all, a society is made up of individual living units, men; just as our bodies are made up of millions of living units, the cells. Therefore, to some extent the future of society is a biological problem. The biologist has the great advantage of being able to sight down the vistas of time as no other scientist can. We have hundreds of millions of years of evolutionary experience to indicate the way things are going. The point there that seems to me particularly striking is that in the evolution of animals and societies we see a decrease of the independence of the units and a greater cooperation of the whole.

MR. OGBURN: Mechanical invention is supporting biological research in this regard. Of course, surely the transportation inventions and communication inventions are going to sometime make the world into one great federation—maybe not in the next twenty-five years.

MR. GERARD: Exactly, and I think that biologically one would say already that isolationism is a biological anachronism.

MR. OGBURN: I see a new angle in this, gentlemen. I am inclined to see, as we all agree, that science is going to bring us many more wonderful things than Aladdin ever dreamed of when he rubbed his magic lantern. But I also want to indicate that it brings responsibilities; it brings maladjustments; and it brings difficulties ahead. Take, for instance, the steel industry. They'll have to adjust to aluminum, will they not?

Mr. Wendt: Surely.

Mr. Ogburn: Take, also, agriculture. The population will have to adjust to the cotton-picker. What will happen to the Negro in that case?

Mr. Gerard: Are these all examples of what you've called the "cultural lag"?

Mr. Ogburn: We never keep up with science. Science is the thing that moves up ahead first, and the social adjustments come along later. Some people advise that we ought to poison all the inventors and scientists until social institutions all catch up. Of course, we don't advocate that here. As a social scientist I would urge that the social scientists step on the gas and move up with their social inventions.

Mr. Wendt: That seems to me, Mr. Ogburn, to be the answer. We need an education that prepares us for change. That is the one thing we don't usually consider—the inevitability of change.

But there's one other thought I'd like to add to this, because I'm sure many people will find that this discussion is quite materialistic, let me say. Science is often accused of limiting itself to the title of this whole subject, which is "Things To Come." It seems to me that the most important aspect of this is that we have the possibility of quantity production of things and of power, more than we can possibly use. The real prospect ahead is not so much things to come as time, as life to come.

Mr. Ogburn: But, also, don't you think that it really brings forward the message of planning? In a world of change, where everything is going to be different in the future from what it was in the past, how can we live a life without planning?

It seems to me that everyone ought to think of this in terms of planning—planning your own business, your own lives in line with these guides which forecast the future, which are really the best things that tell us what is to come, namely, inventions and mechanical discoveries.

Around the Round Table . . . .

Ralph W. Gerard, professor of physiology at the University of Chicago, is a native of Harvey, Illinois, and was educated at the University of Chicago, where he received his B.S. and Ph.D. degrees. Mr. Gerard is also a medical doctor and received his M.D. degree from Rush Medical School in 1925. After his graduation from Rush, Dr. Gerard spent two years as a National Research Fellow in London and Berlin studying the activity of nerves. Since his return to this country, he has been associated with the University of Chicago and has been particularly interested in the study of nerves and the brain. Mr. Gerard has been a pioneer in nerve chemistry and the study of brain waves. He is the author of *Unresting Cells* (1940) and *The Body Functions* (1941), and he was a contributor to *Freedom: Its Meaning* (1940), edited by Ruth Anshen.

William F. Ogburn, Sewell L. Avery Distinguished Service Professor of Sociology at the University of Chicago, is a native of Georgia and did his undergraduate work at Mercer University (Georgia) and was granted a B.S. degree from there in 1905. He received his A.M. and Ph.D. degrees from Columbia University. Dr. Ogburn, before coming to Chicago in 1933, taught at Princeton University, Reed College, the University of Washington, and Columbia University. As well as his academic career, Professor Ogburn has been active in national affairs. He worked for the National War Labor Board during 1918–19 and was a special agent for the Bureau of Labor Statistics in 1919. From 1930 to 1933 he was director of research for the President's Research Committee on Social Trends. He has also served on the Consumers Advisory Committee, N.R.A., the Resettlement Administration, and is consultant and member of the science commission of the National Resources Planning Board. Dr. Ogburn was the editor of *Recent Social Changes* (1933) and *Technological Trend and National Policy* (1937). He is the author of many books, among which are: *Progress and Uniformity in Child Labor Legislation* (1912), *Social Change* (1922), *The Social Sciences* (1927), *Economic Development of Post War France* (1929), *You and Machines* (1935), *Social Characteristics of Cities* (1937), and co-author of *Sociology* (1940).

GERALD L. WENDT, science editor of *Time* magazine, was formerly a member of the department of chemistry of the University of Chicago. He has also served as director and dean of the School of Chemistry and Physics, Pennsylvania State College; director of the Battelle Memorial Institute, Columbus, Ohio; president of the Coffee Products Corporation; director of the American Institute of the City of New York; and research director of the General Printing Ink Corporation. From 1938 to 1940 he was director of science and education for the New York World's Fair. During World War I, he served as a captain in the Chemical Warfare Service of the United States Army. Dr. Wendt received his A.B., his A.M., and Ph.D. degrees from Harvard University. He is the author of *Matter and Energy* (1930), *Science for the World of Tomorrow* (1939), and *Chemistry* (1942), and editor since 1940 of "The Sciences" (a textbook series).

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WHAT DO YOU THINK?

1. What contribution are the scientists able to make to the problem of preventing war and achieving a better life?
2. How much and what kind of control do you think society should exercise over the introduction and use of the findings of scientific research?
3. Should the educational system emphasize the inevitability of change? Is it important for the ordinary citizen to have some idea of how present inventions will change his life? Why?
4. Can science exist in a society where full freedom of thought and research does not prevail?
5. In your opinion what will be some of the social effects of wide use of television? Of plastics? Of air cargo planes? Of more people living longer? Discuss.
6. Do you agree with the speakers that the new inventions are making the world one community? Is isolationism becoming an anachronism, as Mr. Gerard says?
7. What is "cultural lag"? Do you agree with Mr. Ogburn that the social scientists need to make social inventions catch up with science? What are the barriers and obstacles in American society that prevent full and immediate use of the fruits of science?

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238. *Your Taxes*
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241. *Manpower*
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Allentown, Pa.	WSAN	1470	Martinsville, Va.	WMVA	1450
Altoona, Pa.	WFBG	1340	Miami, Fla.	WIOD	610
Asheville, N.C.	WISE	1400	New York, N.Y.	WEAF	660
Atlanta, Ga.	WSB	750	Norfolk, Va.	WTAR	790
Bluefield, W.Va.	WHIS	1440	Philadelphia, Pa.	KYW	1060
Boston, Mass.	WBZ	1030	Pittsburgh, Pa.	KDKA	1020
Charleston, S.C.	WTMA	1250	Portland, Me.	WCSH	970
Charleston, W.Va.	WGKV	1490	Providence, R.I.	WJAR	920
Charlotte, N.C.	WSOC	1240	Reading, Pa.	WEEU	850
Cincinnati, Ohio	WLW	700	Richmond, Va.	WMBG	1380
Clarksburg, W.Va.	WBLK	1400	Rochester, N.Y.	WHAM	1180
Cleveland, Ohio	WTAM	1100	Savannah, Ga.	WSAV	1340
Columbia, S.C.	WIS	560	Springfield, Mass.	WBZA	1030
Detroit, Mich.	WWJ	950	Springfield, Ohio	WIZE	1340
Florence, S.C.	WOLS	1230	Syracuse, N.Y.	WSYR	570
Grand Rapids, Mich.	WOOD	1300	Tampa, Fla.	WFLA	970
Greenville, S.C.	WFBC	1330	Toledo, Ohio	WSPD	740
Greenwood, S.C.	WCRS	1450	Washington, D.C.	WRC	980
Jacksonville, Fla.	WJAX	930	Williamsport, Pa.	WRAK	1400
Johnstown, Pa.	WJAC	1400	Wilmington, Del.	WDEL	1150
Harrisburg, Pa.	WKBO	1230	Winston-Salem, N.C.	WSJS	600
Lakeland, Fla.	WLAK	1340	York, Pa.	WORK	1350
Lima, Ohio	WLOK	1240			

1:00 P.M. CENTRAL WAR TIME

Birmingham, Ala.	WBRC	960	Little Rock, Ark.	KARK	920
Bismarck, N.D.	KFYR	550	Louisville, Ky.	WAVE	970
Chicago, Ill.	WMAQ	670	Madison, Wis.	WIBA	1310
Dallas, Texas	WFAA	820	Mankato, Minn.	KYSM	1230
Des Moines, Iowa	WHO	1040	Mobile, Ala.	WALA	1410
Duluth, Minn., and Superior, Wis.	WEBC	1320	Montgomery, Ala.	WSFA	1440
			Nashville, Tenn.	WSM	650
Eau Claire, Wis.	WEAU	1070	New Orleans, La.	WSMB	1350
El Paso, Texas	KSTM	1380	Oklahoma City, Okla.	WKY	930
Evansville, Ind.	WGBF	1280	Omaha, Neb.	WOW	590
Fargo, N.D.	WDAY	970	Rochester, Minn.	KROC	1340
Fort Wayne, Ind.	WOWO	1190	St. Cloud, Minn.	KFAM	1450
Hattiesburg, Miss.	WFOR	1400	Shreveport, La.	KTBS	1480
Hibbing, Minn.	WMFG	1240	Sioux Falls, S.D.	KSOO	1140
Houston, Texas	KPRC	950	Springfield, Mo.	KGBX	1260
Indianapolis, Ind.	WIRE	1430	Terre Haute, Ind.	WBOW	1230
Kansas City, Mo.	WDAF	610	Tulsa, Okla.	KVOO	1170
Kingsport, Tenn.	WKPT	1400	Virginia, Minn.	WHLB	1400
La Crosse, Wis.	WKBH	1410	Wichita, Kan.	KANS	1240

12:00 M. MOUNTAIN WAR TIME

Albuquerque, N.M.	KOB	1030	Phoenix, Ariz.	KTAR	620
Billings, Mont.	KGHL	790	Pocatello, Ida.	KSEI	930
Boise, Ida.	KIDO	1380	Safford, Ariz.	KGLU	1450
Bozeman, Mont.	KRBM	1450	Salt Lake City, Utah	KDYL	1320
Butte, Mont.	KGIR	1370	Tucson, Ariz.	KVOA	1290
Denver, Colo.	KOA	850	Twin Falls, Ida.	KTFI	1270
Helena, Mont.	KPFA	1240	Yuma, Ariz.	KYUM	1240

11:00 A.M. PACIFIC WAR TIME

Bakersfield, Cal.	KERN	1410	Sacramento, Cal.	KFBK	1530
Fresno, Cal.	KMJ	580	San Diego, Cal.	KFSD	600
Los Angeles, Cal.	KFI	640	Seattle, Wash.	KOMO	950
Medford, Ore.	KMED	1440	Spokane, Wash.	KHQ	590
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